

THIS OPINION WAS NOT WRITTEN FOR PUBLICATION

The opinion in support of the decision being entered today (1) was not written for publication in a law journal and (2) is not binding precedent of the Board.

Paper No. 22

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte KAZUHIKO KUMAZAWA, WATARU KOTANI
and MASAOMI KAMIYA

Appeal No. 97-1078
Application 08/488,056¹

HEARD: May 4, 1999

Before FRANKFORT, McQUADE and NASE, Administrative Patent Judges.

McQUADE, Administrative Patent Judge.

DECISION ON APPEAL

Kazuhiko Kumazawa et al. appeal from the final rejection of claims 12 through 22, all of the claims pending in the

¹ Application for patent filed June 7, 1995.

application.² We reverse.

The invention relates to "a honeycomb regenerator for recovering a waste heat in an exhaust gas by passing the exhaust gas and gas to be heated alternately therethrough" (specification, page 1). Claim 12 is illustrative and reads as follows:

12. A honeycomb regenerator for recovering waste heat from exhaust gas, comprising:

a stacked assembly including at least one first honeycomb body and at least one second honeycomb body stacked on said at least one first honeycomb body, each honeycomb body including a plurality of passages extending along an axial direction of the stacked assembly, said at least one first honeycomb body comprising a ceramic material having anti-corrosive properties, and said at least one second honeycomb body comprising a ceramic material having a main crystal phase of cordierite, said stacked assembly including first and second opposite axial ends respectively forming an inlet for hot exhaust gas and an inlet for cold gas, wherein said at least one second honeycomb body is provided downstream of said at least one first honeycomb body along a flow direction of the hot exhaust gas.

The items relied upon by the examiner as evidence of obviousness are:

Davies et al. (Davies)	3,326,541	Jun. 20,
1967 Ogawa et al. (Ogawa)	4,489,774	Dec.
25, 1984		

² Claims 14 and 15 have been amended subsequent to final rejection.

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Oda et al. (Oda) 4,601,332 Jul. 22,
1986

The items relied upon by the appellants as evidence of non-obviousness are:

The 37 CFR § 1.132 Declaration of Wataru Kotani and its accompanying exhibits (Paper Nos. 14 and 16).

Claims 12 through 15 and 20 through 22 stand rejected under 35 U.S.C. § 103 as being unpatentable over Davies in view of Oda, and claims 16 through 19 stand rejected under 35 U.S.C. § 103 as being unpatentable over Davies in view of Oda and Ogawa.³

Reference is made to the appellants' main and reply briefs (Paper Nos. 12 and 14) and to the examiner's main and supplemental answers (Paper Nos. 13 and 17) for the respective positions of the appellants and the examiner with regard to the merits of these rejections.

Davies, the examiner's primary reference, discloses a pair of regenerators 12 which are alternately heated by waste gas flowing out of a glassmaking melting tank 10 and cooled by

³The examiner has withdrawn the 35 U.S.C. § 112, second paragraph, rejection of claims 14 and 15 which was set forth in the final rejection (see the advisory action dated July 18, 1996, Paper No. 9).

combustion air flowing into the tank. Each of the regenerators includes a network or checker setting 13 of refractory brick. The checker settings have three wear zones: the top checkers 13T, the middle checkers 13M and the bottom checkers 13B. According to Davies, "[t]he dominant service factors in the top checkers are different than the middle and lower zones. But, generally, the same factors are present to some degree in all zones" (column 2, lines 15 through 19). In this regard, Davies observes that

[f]our fundamental destructive effects have been recognized as having a direct bearing on checkerbrick life: (1) temperature cycling; (2) oxidation-reduction; (3) solid carryover; and (4) volatile carryover. In the top checker settings, high-temperature cycling is a serious factor, decreasing towards the middle where it overlaps with low-temperature cycling effects. The atmosphere in the top zone is laden with alkali vapors, although condensation is insignificant. Solid carryover is greatest. Oxidation-reduction conditions may vary from mild to severe.

In the middle zone, temperature fluctuations are relatively mild. Solid carryover is low and, because of lower temperatures, less reactive. The atmosphere is rich in alkali vapors, and some deposition of condensates occurs. Oxidation-reduction conditions may be present, but the effects are of less importance because of lower temperatures.

In the lower zone, temperatures are quite low, but the temperature cycles may be wide where cold incoming air enters the checker setting. The

dominant characteristic of this zone is a large amount of condensing volatile constituents from the exhaust gases. Effects of oxidation-reduction and solid carryover on the refractories in this area are insignificant, although plugging may occur from the entrapment of solid dust fragments from higher up in the setting [column 2, lines 41 through 66].

Davies' objective is to provide a regenerator structure which will have "a longer and more uniform service life" (column 1, lines 59 and 60). To this end, the reference teaches that

[t]he lower sections of the checker setting are comprised of chrome or chrome-magnesite brick. Middle settings are selected from stabilized forsterite, magnesite, or chrome-magnesite brick. The upper checker settings, which are the most critical, are comprised of burned or unburned high-purity magnesite brick, on an oxide basis, by weight, analyzing at least 90% MgO up to about 2% total Al_2O_3 plus Fe_2O_3 plus Cr_2O_3 , there being lime and silica present, the lime/silica weight ratio being greater than 2:1. In a preferred embodiment the top checker settings are comprised of magnesite brick containing by weight on an oxide analysis of at least 95%, of MgO up to about 1%, by weight total Al_2O_3 plus Fe_2O_3 plus Cr_2O_3 , there being lime and silica present, the lime/silica weight ratio being about 2:1 [column 2, lines 25 through 40].

The examiner concedes (see page 4 in the main answer) that Davies does not meet the limitation in independent claim 12 requiring the second honeycomb body to comprise a ceramic material having a main crystal phase of cordierite.

Oda pertains to ceramic honeycomb heat exchangers. Of the particular ceramic materials to be used, Oda teaches that materials having high heat resistance and thermal shock resistance are preferable for effectively utilizing the heat exchange of the hot fluid. Ceramic materials having low thermal expansion, such as cordierite, mullite, magnesium aluminum titanate, silicon carbide, silicon nitride and a combination of these materials are desirable. These materials are excellent in heat resistance and are small in thermal expansion coefficient . . . so that these materials can endure rapid temperature . . . change [column 2, lines 49 through 59].

In combining Davies and Oda to support the rejection of claim 12, the examiner concludes that it would have been obvious at the time the invention was made to a person having ordinary skill in the art "to employ in the appropriate portion [13M] of Davies et al. known regenerator construction material such as cordierite . . . for the purpose of obtaining high heat resistance and thermal shock resistance as disclosed in Oda et al." (main answer, page 4). The examiner further explains that

[t]he middle layer (13M) or [sic, of] the regenerator of Davies et al. is made from a material (forsterite, see column 2, lines 27-29) selected for its resistance to heat and low expansion property/low temperature shock. Forsterite is known in the ceramics art to have a low expansion coefficient which is in the range of the low

expansion coefficient of the claimed material cordierite (see the thermal expansion coefficients of Cordierite and Forsterite on page 759 of Vol. 4 of Engineered Materials Handbook^[4]). Therefore, Cordierite and Forsterite are functionally equivalent in their expansion coefficients and it is considered to be obvious to substitute Cordierite, with its known low expansion property for Forsterite and its known low expansion property in view of the teaching in Oda et al. of the use of cordierite in heat exchangers for the purpose of obtaining high heat resistance and thermal shock resistance [main answer, pages 6 and 7].

The examiner's position here is unsound for a number of reasons.

To begin with, Davies does not provide any factual support for the examiner's assertion that forsterite was selected for use in the middle layer or zone 13M of the Davies regenerators due to a low thermal expansion property.

Moreover, the examiner's determination that the forsterite disclosed by Davies and the cordierite disclosed by Oda have "functionally equivalent" coefficients of thermal

⁴The record indicates that a copy of the pertinent portion of this reference was mailed to the appellants with the main answer (Paper No. 13). Since the reference was not included in the statements of the rejections on appeal, its use by the examiner to support the rejections is somewhat suspect. See In re Hoch, 428 F.2d 1341, 1342 n.3, 166 USPQ 406, 407 n.3 (CCPA 1970).

expansion, and thus similar thermal shock resistances, is refuted by the Kotani declaration submitted by the appellants. By a clear preponderance of evidence, this declaration and its accompanying exhibits establish that the coefficient of thermal expansion of forsterite is significantly higher than that of cordierite, notwithstanding the indication to the contrary in the handbook material relied upon by the examiner.

Finally, Davies' disclosure that the temperature and temperature fluctuations in zone 13M are relatively mild belies the examiner's reasoning that the artisan would have found it obvious to substitute cordierite for forsterite in this zone for the purpose of obtaining high heat and thermal shock resistance.

In this light, we are constrained to conclude that the only suggestion for combining Davies and Oda in the manner proposed by the examiner stems from hindsight knowledge impermissibly derived from the appellants' own disclosure. Ogawa, applied by the examiner in support of the rejection of dependent claims 16 through 19, does not cure this fundamental flaw in the Davies-Oda combination.

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Accordingly, we shall not sustain the standing 35 U.S.C.
§ 103 rejection of independent claim 12 or of claims 13
through 22 which depend therefrom.

The decision of the examiner is reversed.

REVERSED

CHARLES E. FRANKFORT
Administrative Patent Judge

JOHN P. McQUADE
Administrative Patent Judge

JEFFREY V. NASE
Administrative Patent Judge

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